भारतीय मानक

Indian Standard

IS 19041 : 2023

मोटा अनाज (श्रीअन्न) से कंकड़ पत्थर हटाने का यंत्र — विशिष्टि एवं परीक्षण संहिता

Destoner for Millets — Specification and Test Code

ICS 65.060

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Agriculture and Food Processing Equipment Sectional Committee, FAD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Agriculture and Food Processing Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

Millets are exceptionally nutritious and were once a dietary staple. However, changing consumer preferences and a lack of millet processing resources led to a decline in their consumption. Millets require processing before consumption, and the government initiated efforts to promote millet consumption during the 2023 International Year of Millet (IYOM - 2023). Equipment used in millet processing are very crucial for ensuring the quality of processed millets. Therefore, it is important to establish equipment standards to maintain the overall quality and promote the consumption of this valuable and nutritious grain, benefiting both health and the economy.

Destoning of seeds/grains is an important post-harvest processing operation which upgrades the quality of seeds/grains and thereby its commercial value. Therefore, a need was felt to develop a standard to assure the quality and for performance certification purpose, standards for the specifications and the test methods will ensure quality of this equipment manufactured and thus the quality of the process and the produces/products. This standard will also serve as guidance to the manufacturers of this equipment.

A series of Indian Standards are being developed on the equipment used in primary processing of millets. Apart from this standard, three other standards on millets processing equipment have been published which are as under:

IS 19039 : 2023 Cleaner cum grader for millets with pre-cleaner — Specification and test code
IS 19040 : 2023 Millet Dehusker — Centrifugal Type — Specification and test code
IS 19042 : 2023 Symbols and flow diagram for primary processing of millets

Another standard covering the specification for pearler-cum-polisher for millets is under preparation IS XXXX : 20xx.

The composition of the Committee responsible for the formulation of this standard is given in Annex L.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

Indian Standard

DESTONER FOR MILLETS — SPECIFICATION AND TEST CODE

1 SCOPE

This standard specifies material, construction, performance and other requirements of destoner for millet crops. It also prescribes the test methods for evaluating the performance of the destoner.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this standard, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Adjustments — The destoner has many adjustments which allow the operator to control the separating action precisely which are given in **3.1.1** to **3.1.4**.

3.1.1 *Feed Regulating Mechanism* — The mechanism which regulates the feed rate in the destoner.

3.1.2 *Air Control Device* — A mechanism at the air-inlet to the fans which regulates the air velocity or air pressure through the deck base and surface material at the outlet.

NOTE — Air is used for stratification of seed/grain material vertically on the deck, in which seed of higher specific gravity fall through the substrata while seed of lower gravity will be buoyed up the strata.

3.1.3 *Deck Slope* — Slope of deck from the feed hopper to the extreme discharge end, which controls the output capacity of the machine.

3.1.4 *Deck Oscillation Speed Control* — The mechanism which regulates the motion of the deck per unit time.

3.2 Blower — A device to produce air blast by taking the atmospheric air through suction.

3.3 Body — It is the stationary machine base frame with fans and air chamber connected with the deck with flexible tarpaulin shroud.

3.4 Deck — The deck is the adjustable frame fitted in the body with oscillating mechanism or table on which fluidization of material and separation is affected.

3.5 Cleaned Seed/Grain — The seed/grain lot which is free from chaff, dust, undersize impurities, oversize impurities, stones, metal pieces, seeds/grains of other crops, seeds/grains of other varieties, damaged seeds, etc are as removed using appropriate processing units.

3.6 Feed Rate — The quantity of the cleaned seed/grain fed into the destoner per unit time. It is important to maintain steady feed rate after machine setting to ensure quality.

3.7 Foreign Matter — It includes inorganic and organic matters. The inorganic matter shall include sand, gravel, dirt, pebbles, stones, lumps of earth, mud, iron chips, etc. The organic matter shall include chaff, straw, weed seeds, dead insects, worms, other inedible grains, etc.

3.8 Rated Input Capacity — The feed rate at which the cleaning efficiency is within the specified limit.

3.9 Routine Tests — Tests carried out on each equipment to check the requirements which are likely to vary during production.

3.10 Specific Gravity Separator — A machine used for upgrading cleaned seed/grain passed through an air-screen-cleaner. It separates from uniform sized seeds/grains, lighter immature and insect damaged, rain damaged seed and heavy inert material based on specific gravity of different components in order to get good seed. The separation is achieved with the co-ordination of number of adjustments among machine parameters.

3.11 Type Tests — Tests carried out on destoner to prove conformity with the requirements of relevant standard. These are intended to prove the general qualities and design of a particular type of destoner.

3.12 Unclean Seeds/Grains — The mixture of clean seeds/grains and foreign matter.

4 TYPES OF MILLETS AND DESTONER

4.1 Millet Grains

Millets are the group of small grains and following are the crops classified under millets as given in Table 1, which can be processed by this equipment. These grains are equally rich in nutrients to rice and wheat. Though they look similar in shape and size, they differ and cleaning/grading require different sieve perforations.

4.2 Destoner

Destoner utilizes the difference in mass (density/specific gravity) between the stone/mud present in the grains and the good grains for segregation under continuous vibration and air flow. The destoner may be only as a destoner or with an aspirator or destoner with grader and aspirator. Destoner plays a crucial role during pre and post hulling operations and thereby helps in improving the quality of the output. Use of destoner for removing the stones in the feed material is essential to prevent damage to the sensitive/soft natured components in the processing units. Also removing the stones after the processes ensures removal of stones in the final product. By using this machine, drudgery to the labourers is reduced and the quantity of material processed in unit time is increased many fold.

The destoner consists of a vibrating deck, feed hopper with feed regulator, blower, cam mechanism for vibration, etc. The destoner will have a capacity range of 300 kg to 2 tonnes per hour and operated by 2 hp to 5 hp electric motor. The vibrating deck made of dimple sheet is mounted on suitable bearings and connected to the cam through a connecting rod (Fig. 1 and Fig. 2). The main frame houses the blower, motor, power transmission system and cam mechanism and closed on all sides with opening at top. The suction of the blower is placed on one of the sides of the frame with a shutter to control the flow and the air blast is delivered at the bottom of the deck through a flexible duct. The vibrating duct is placed with an inclination on the bearings and has provision to adjust the inclination in the range of 15 degree to 20 degree. The deck along the tail end is extended outside the frame and is narrowed as an outlet, normally for the cleaned seeds/grains. The other end in the upward slope is also extended outside the frame and narrowed towards an outlet for the heavier objects (stones). A stopper is provided at the end of the upward slope to prevent flowing of the stones to the deck when the deck vibration comes to halt. A hopper with feed regulator mechanism is placed with suitable supports above the deck.

Table 1 Common Name and Botanical Name of Millet Crops

(*Clause* 4.1)

Sl No.	Common Name of Millets	Botanical Name
(1)	(2)	(3)
i)	Sorghum/Jowar/Great millet	*Sorghum bicolor*
ii)	Pearl millet/*Bajra*	*Pennisetum glaucum*
iii)	Finger millet/*Ragi*	*Eleusine coracana*
iv)	Kodo millet	*Paspalum scrobiculatum*
v)	Foxtail/Italian millet	*Setaria italic*
vi)	Little millet/Kutki millet	*Panicum sumatrense*
vii)	Proso/Common millet	*Panicum miliaceum*
viii)	Barnyard millet	*Echinochloa esculenta*
ix)	Browntop millet	*Urochloa ramose*

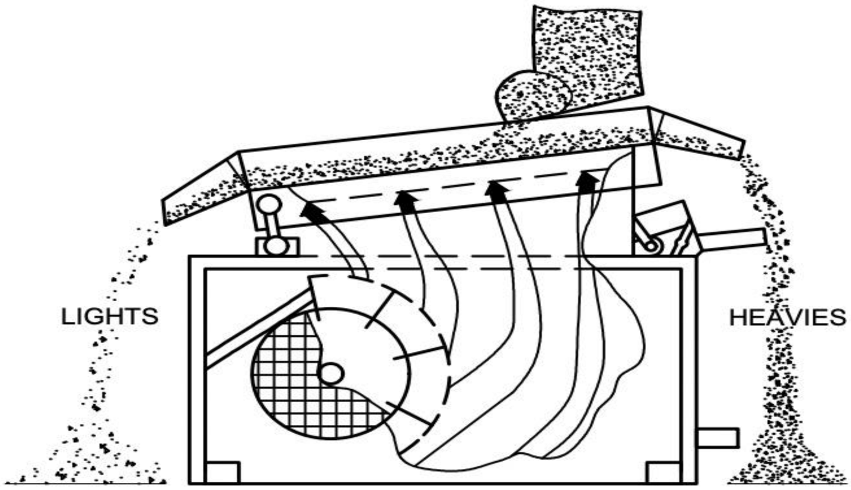

FIG. 1 SCHEMATIC DIAGRAM OF DESTONER SHOWING PRINCIPLES OF OPERATION

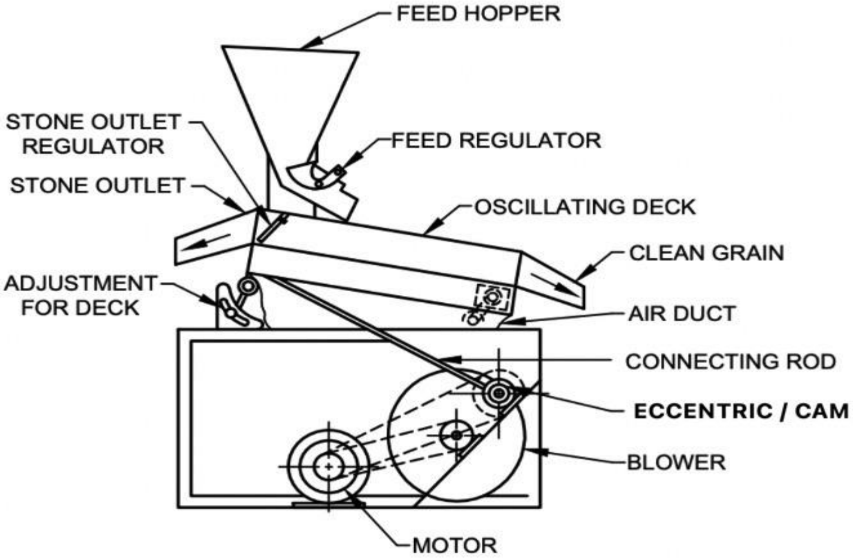

FIG. 2 SCHEMATIC DIAGRAM OF DESTONER SHOWING THE MAJOR COMPONENTS

When the destoner is operated, the blower delivers the blast of air to the vibrating deck from the bottom. The bed of seed/grain mass received on the deck from the hopper will undergo stratification vertically on the deck, in which seed/grain of higher mass (density/specific gravity) fall down through the substrata while seed/grain of lower mass (density/specific gravity) will be buoyed up the strata. This separation and the vibration of the deck make the stones to move upwards and the good seeds/grains downwards towards the appropriate outlets/chutes. The parameters like, slope of the deck, air flow rate and feed rate will be adjusted according to the millet crop to achieve higher performance.

5 MATERIALS

5.1 The material of construction of various components of destoner shall be as given in col (3) of Table 2. The material may confirm to the relevant Indian Standards given in col (4).

Table 2 Material of Construction

(*Clause* 5.1)

Sl No. (1)	Component (2)	Material (3)	Reference to IS (4)
i)	Air control shutters	Mild steel	IS 2062
		Galvanized sheet	IS 277
ii)	Bearing housing/Plummer block	Cast iron	IS 210
iii)	Blower casing	Mild steel	IS 2062
		Cast iron	IS 210
iv)	Blower impeller (blade holder)	Cast iron	IS 210
v)	Bottom and top drum of elevator	Cast iron	IS 210
vi)	Bucket/cups	Mild steel/plastics	IS 2062
vii)	Cam	High carbon steel	IS 7226
viii)	Deck	Mild steel	IS 2062
		Stainless steel (SS 304)	IS 6911
ix)	Discharge spout	Mild steel	IS 2062
		Galvanized sheet	IS 277
		Stainless steel (SS 304)	IS 6911
x)	Elevator body/frame	Mild steel	IS 2062
		wood	IS 399
xi)	Feed hopper	Mild steel	IS 2062
		Stainless steel (SS 304)	IS 6911
xii)	Frame	Mild steel	IS 2062
		Galvanized iron	IS 277
xiii)	Gears	High carbon steel	IS 7226

Table 2 (*Concluded*)

Sl No.	Component	Material	Reference to IS
(1)	(2)	(3)	(4)
xiv)	Hand wheels/adjustment levers	Cast iron	IS 210
		Mild steel	IS 2062
xv)	Pullies	Cast iron	IS 210
		Mild steel	IS 2062
xvi)	Screens/sieves	Mild steel	IS 2062
		Stainless steel (SS 304)	IS 6911
xvii)	Shafts	Mild steel	IS 2062

5.2 The wire cloth sieve and perforated type sieve should conform to IS 2405 (Part 1) and IS 2405 (Part 2) respectively.

6 CONSTRUCTIONAL REQUIREMENTS

6.1 Frame

The main frame shall be fabricated using suitable size of mild steel/galvanized iron with channel/angle sections and shall be covered wherever required with mild steel sheet/galvanised sheet/stainless steel sheet of adequate thickness, not less than 1.0 mm thickness, depending on the requirements and provided with gasket/packing to prevent leakage of air.

6.2 Hopper

Hopper shall be made of mild steel/stainless steel (SS 304) sheet and provided with a feed regulating device. The hopper will be provided with side slope for easy flow of the grains/kernels. The feed hopper will be located at appropriate height from ground level for easy filling manually. Alternatively, the unit may be provided with a bucket elevator for filling the hopper.

6.3 Blower

Blower will be of adequate size and the impeller is balanced and mounted on self-aligned bearings to run without vibration and the casing will be strong enough. The shutter to adjust the air flow rate will be provided with a locking arrangement to hold the position and ensures noise/vibration free running.

6.4 Vibrating Deck

The deck shall be provided with appropriate slope range and with provision to adjust the slope to suit various millet crops. The screen used in the deck will be with suitable perforation permitting the air flow and preventing the grains/seeds to pass through.

6.5 Transmission Drive

The suitable drive system using V-belt pulley system for transmitting the power shall be provided in the destoner.

6.6 Shafts

The shafts shall be supported with suitable bearings and housings on the stable part of machine.

6.7 Outlet/Chute for the Sound Grains and Reject Grains/Stones

The outlet for the good grains shall be placed at the suitable height from ground for easy collection/filling in gunny bags. The reject/stones outlet will also be provided with easy collection/filling in gunny bags.

6.8 Surface Finish

All the joints and surfaces shall be made smooth and protected from weather conditions.

7 PERFORMANCE REQUIREMENTS

7.1 When tested in accordance with the method given in 10, the destoner shall confirm to the following requirements:

a) Improvement in quality of seed/grain between input to destoner output shall be 25 percent minimum;

b) The percentage of heavier impurities/stones collected along good grain/seed shall not be more than 5 percent; and

c) The percentage of good seeds/grains collected in stone outlet shall not be more than 5 percent.

7.2 The destoner shall withstand the tests given under 10.

7.3 The destoner shall be operated at no load in accordance with the method given in **8** of IS 5718. During the no-load run, the visual observation shall not show the following abnormalities:

a) Presence of any marked vibrations during operation;
b) Presence of undue knocking or rattling sound;
c) Frequent slippage of belts/chains;
d) Non-smooth running of shafts in the bearing housings;
e) Any marked wear or slackness in any components;
f) Any marked rise in temperature of operational bearings and its housing;
g) Vibrations in running of blowers; and
h) No mechanical damage to any components of the destoner.

7.4 The rated input capacity in quintals per kWh energy consumed, with 5 percent and 10 percent heavier objects/stones, shall be declared by the manufacturer. The various adjustments, namely, slope, air flow rate, etc shall also be declared. When tested in accordance with the method given in **9.1.9** of IS 8440, the declared capacity shall not differ by ± 5 percent.

7.5 During and after the capacity test, the visual observation shall not indicate the following:

a) Observations given under 7.3(a) to 7.3(h);
b) Frequent clogging of screen perforations;
c) Non-smooth flowing of material through different components;
d) Frequent clogging of hopper;
e) Any marked wear, deformation and breakdown;
f) Frequent loosening of fasteners; and
g) Leakage of grains from the deck while in operation.

7.6 When tested in accordance with **9.2** of IS 8440, no breakdown shall occur in any units of the destoner.

7.7 When tested in accordance with the method given in 10, the destoner shall conform to the following requirements:

a) The grader shall meet the requirement given in 7.1; and
b) The input capacity of the millet grains per kWh energy used shall be not less than 500 kg/kWh. The capacity shall be declared by the manufacturer.

7.8 The rated input capacity in tonnes/h and rated energy consumption in kWh/tonne for raw seeds/grains with 10 percent to 20 percent impurities like chaff, dust, soil particles, discoloured seeds/grains, cut and damage seeds/grains, for millets shall be declared when tested in accordance with the method given in IS 5718 or IS 8440. The declared value shall not differ by 5 percent. The effectiveness of stone separation shall not be less than 0.90. It means 90 percent of the stones/mud will be separated by the destoner from the millet kernels/grains.

8 OTHER REQUIREMENTS

8.1 The necessary bearings, eccentric/cam, variable pulley and proper drive system shall be provided.

8.2 The necessary provisions for application of grease/oil for bearings and other moving parts of the destoner shall be provided. Also they shall be dust proof.

8.3 The construction shall be such as to help easy and immediate repairs and maintenance.

8.4 The machine shall be provided with easy facilities for adjustments (*see* **3.1**).

8.5 Provision for tightening belts/chains shall be provided.

8.6 The destoner shall be provided with the operator's manual (*see* **4.2** of IS 8132).

8.7 Provision for changing/adjusting the following shall be made:

a) Feed rate;
b) Air displacement; and
c) Deck slope.

9 WORKMANSHIP AND FINISH

9.1 The components of destoner shall be free from cracks, pits and other visual defects which may be detrimental for their use.

9.2 The welding and joints, if any, shall not be porous and shall be smooth (*see* IS 816).

9.3 The rust preventive coating shall be provided to the steel components and varnish to the wooden components.

9.4 The controls and adjustments provided shall be easy and smooth to operate.

10 METHODS OF TEST FOR DESTONER

10.1 Selection and Specification of Destoner for Type Tests

10.1.1 *Selection*

The destoner shall be taken from the series production by the testing authority with the agreement of the manufacturer.

10.1.2 *Specification*

The manufacturer shall supply specification sheet duly filled in as given in Annex B as well as any further information required to carry out the tests. The manufacturer shall also supply all literature, operational manual and schematic diagram of grain flow in the destoner. The manufacturer shall also indicate the maximum input capacity and rated input capacity with the foreign matter at 5 percent and 10 percent.

10.2 Test Material

10.2.1 Sufficient quantity of the raw material (millet grains namely, sorghum, *bajra*, finger millet, banyard millet, proso millet, little millet, fox tail millet, kodo millet, brown top millet, etc), preferably the same variety shall be taken. The proportion of impurities, stones, mud, chaff, plant materials, etc shall be analyzed by taking 5 samples each of 100 g and the average shall be reported. The grain/seed lot selected for testing destoner shall have purity in the range of 70 percent to 80 percent.

10.2.2 The moisture content of test material shall be measured according to IS 4333 (Part 2) and shall be not more than 14 percent (wet basis).

10.3 Running in and Preliminary Adjustments

10.3.1 The destoner shall be installed on a level and preferably on a hard surface with anti-vibration mount/concrete foundation. All the adjustments shall be made in accordance with the manufacturer's recommendation.

10.3.2 The destoner shall be attached with a suitable prime mover, preferably with an electric motor and auto-voltage stabilizer. An energy meter or some form of transmission dynamometer shall be fitted. The power delivered to the destoner may be supplied in the following ways:

a) Direct coupling the prime mover with the main shaft of the destoner; and
b) Connecting the prime mover with the help of a flat or V-belt and pullies with the destoner's main shaft.

In the case of (a), the power delivered to the grader would be the power output of the prime mover, whereas in the case of (b), the allowances for flat and V-belt drive losses may be taken at 6 percent and 3 percent respectively.

10.3.3 The destoner shall be run-in without load before commencing the tests. The running-in shall be carried out in accordance with the manufacturer's recommendation. In the absence of any recommendation by the manufacturer, the destoner shall be run-in for 30 min. During the period of the run-in, adjustments for various functional components may be done. All the adjustments done shall be in accordance with the instructions contained in the manual supplied by the manufacturer.

10.4 Tests

Tests as indicated in **10.4.1** shall becarried out on millet destoner.

10.4.1 *Type Tests*

10.4.1.1 *General*

a) Checking of specifications (Annex B);
b) Checking of material (*see* **5.1** and Annex C); and
c) Visual observations and checking of provisions for adjustments (*see* **7.5** and Annex D).

10.4.1.2 *Test at no-load*

a) Power consumption (*see* Annex E) shall be recorded from the start and closing reading of energy meter.

b) After running-in is over, the destoner shall be run at no load for 10 min at the specified speed. During and after the no load run, the visual observation at the destoner shall not show the following:

    1) Presence of any marked vibration during operation;
    2) Presence of undue knocking or rattling sound;
    3) Any marked rise in bearing temperature;
    4) Any marked unusual wear or slackness in any component; and
    5) Any marked change in oscillation or slopes.

c) Data shall be recorded in accordance with the proforma given in Annex D.

10.4.1.3 *Test at load*

a) Operation and collection of data

The destoner shall be operated at its input capacity specified by the manufacturer for the particular crop grain/seed and variety, incorporating best combination of adjustments for a period of 30 min. During the running period, speed of shaft, speed of oscillation, deck slope, air control lever position, etc shall be noted and recorded in Annex F.

Three sets of samples, from the feed, at the sound grain outlet and reject grain/stone outlet, either manually after each 10 min or continuously by automatic flow samplers for the entire period shall be collected.

b) Preparation and analysis of samples

1) The samples drawn from each outlet shall be bulked and thoroughly mixed to form a composite sample.

2) Each sample shall be further divided using a sample divider to get 100 g of representative sample.

3) Each 100 g sample shall be manually analyzed for physical purity to find the percentage availability of the stones and the good grains/seeds and recorded in Annex G.

(1)	(2)	(3)	(4)
i)	Fraction 1 (*F*)	Feed material	To be analyzed for the fraction of good seeds/grains in the feed.
ii)	Fraction 2 (*E*)	Good grains/seeds outlet	To be analyzed for the fraction of good seeds/grains received in the good grains/seeds outlet
iii)	Fraction 3 (*G*)	Stones outlet	To be analyzed for the fraction of good grains/seeds received in the stones/ reject outlet

c) Determination of effectiveness of stone separation

The effectiveness of separation shall be calculated by the following formula:

$$D = \frac{E \times (F - G) \times (E - F) \times (1 - G)}{F \times (E - G)^2 \times (1 - F)}$$

where

D = effectiveness of stone separation, decimal;

E = mean of fraction of good seeds/grains at good grain/seed outlet;

F = fraction of good seeds/grains in feed; and

G = mean of fraction of good seeds/grains at rejection/ stones outlet.

Record the data in the data sheet as given in Annex G.

d) Determination of power consumption

The power requirement during the test run shall be calculated/measured in accordance with the following methods and record the data in accordance with Annex H.

1) In case of prime mover fitted with an energy meter, the readings taken shall be the power consumption for 10 min. The power consumption per hour giving due allowance to the type of drive shall be calculated and reported.

2) In case of prime mover fitted with the dynamometer, the reading taken shall indicate the torque required. The power consumption, giving due allowance to the type of drive, shall be calculated by the following formula:

$$P = \frac{T \times S}{9\,549.30} \times 100$$

where

P = power, in kW;
T = torque, in Nm; and
S = speed, in rpm.

NOTE — For the purpose of certification, the power consumption at the declared feed rate shall only be calculated.

3) Determination of the rated input capacity — From the quantity of feed (kg) taken for the test and the time taken (in minutes) to remove the stones, capacity is calculated and expressed as ton/h. The capacity in terms of the energy consumed shall be calculated by dividing the capacity by power consumed and shall be expressed in kg/kWh. Record the data in Annex G.

NOTE — For the purpose of certification, since the separator has been operated only at declared capacity, it shall be seen whether the effectiveness of stone separation is met at the declared capacity or not.

10.4.1.4 *Routine tests*

a) Visual observations and checking of provision for adjustments (*see* **10.4.1.1**); and

b) Test at no-load (*see* **10.4.1.2**).

10.4.1.5 *Long run test*

The destoner shall be operated for a minimum duration of 20 h at no load which could be covered by continuous run of at least 5 h. During and after the operation no breakdown or defects shall develop in the destoner. Record the major breakdowns, defects developed, and repairs made into the data sheet given in Annex J.

10.5 Summary Report

For the guidance of the user, compile a summary report on the proforma as given in Annex K.

11 MARKING AND PACKING

11.1 Marking

Each destoner shall be marked with the following particulars:

a) Manufacturers' name, address and trade-mark;
b) Type and model number;
c) Year of manufacture;
d) Power rating and capacity;
e) Drive details like direction of rotation, number of oscillations of deck/min/speed of main shaft (rpm), air velocity of fan (m/min), etc; and
f) Batch or code number, if any.

11.2 A minimum cautionary notice worded as follows shall be written in vernacular language legibly and prominently on the main body of the destoner:

a) Do not wear loose dress, bangles, watch, etc, while working with the destoner;

b) Do not work under the influence of intoxicants like liquor, opium, etc;

c) Children and aged persons should be discouraged for working on destoner;

d) Do not make adjustments when destoner is working; and

e) Do not put or take-off belt while pulley is running.

11.3 Packing

The destoner shall be packed for safety and security of human being while in transit and as agreed to between the purchaser and supplier for safe handling in transit.

12 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed there under, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause 2*)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 210 : 2009	Grey iron castings — Specification (*fifth revision*)
IS 277 : 2018	Galvanized steel strips and sheets (plain and corrugated) — Specification (*seventh revision*)
IS 399 : 1963	Classification of commercial timbers and their zonal distribution (*revised*)
IS 816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (*first revision*)
IS 2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
IS 2405	Industrial sieves — Specification:
(Part 1) : 2023	Wire cloth sieves (*second revision*)
(Part 2) : 2023	Wire sieves (*second revision*)
IS 4333 (Part 2) : 2017/ ISO 712 : 2009	Methods of analysis for food grains: Part 2 — Determination of moisture content (*second revision*)
IS 5718 : 2000	Agricultural produce processing equipment — Seed cleaners — Test code
IS 6911 : 1017	Stainless steel plate, sheet and strip — Specification (*second revision*)
IS 7226 : 1974	Specification for cold-rolled medium, high carbon and low alloy steel strip for general engineering purposes
IS 8132 : 2023/ ISO 3600 : 2022	Tractors and machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and format (*third revision*)
IS 8440 : 2023	Paddy cleaners — Test code (*first revision*)

ANNEX B

(*Clauses* 10.1.2 *and* 10.4.1.1)

SPECIFICATION SHEET

Manufacturer Testing Station

B-l GENERAL

a) Make
b) Model
c) Type
d) Year of manufacture
e) Recommended grains for stone separation

B-2 POWER UNIT

a) Type of prime mover
b) Recommended power, in kW
c) Type of drive

B-3 MAIN DRIVE

a) Type
b) Size of belt
c) Size of pulley, in mm
d) Diameter of main shaft, in mm
e) Type and number of bearings
f) Size of connecting rod, in mm
g) Size of cam or eccentric, in mm

B-4 DECK

a) Size (length and width), in mm
b) Construction of deck
c) Type of perforation/dimple/surface nature
d) Thickness of deck, in mm
e) Size of perforation, in mm
f) Number of perforations/100 cm^2
g) Pitch of perforations, in mm
h) Provision to adjust end slope
j) Provision to vary the vibration/oscillation speed of deck

B-5 BLOWER

a) Number of blowers
b) Type of blower
c) Type of drive
d) Speed of impeller, in m/min (rpm)
e) Provision to adjust velocity/flow rate
f) Protection against entry of insects/dust along air
g) Protection against dress/arm getting in
h) Provision for easy cleaning

B-6 FEEDING

a) Method of feeding
b) Location of inlet

c) Type of feed regulation mechanism (baffle/shutter, etc)
d) Height of feeding hopper from ground level in installed condition, in m
e) Capacity of hopper, in m^3 or kg
f) Provision for elevator

B-7 OUTLETS

a) Number of outlets
b) Height of outlets from ground level in installed condition, in mm
c) Projection of outlets from frame, in mm
d) Type
e) Construction details

B-8 FRAME DETAILS

a) Construction
b) Easy of dismantling and assembling
c) Overall dimension of the unit (L × B × H, in mm)

B-9 TOOLS, ACCESSORIES AND MANUALS PROVIDED

NOTES
1 The items which are not applicable in a particular destoner should be crossed while filling.
2 If other items are provided, their details should be filled in.

Test Engineer

ANNEX C

(*Clause* 10.4.1.1)

DATA SHEET FOR MATERIAL OF CONSTRUCTION

C-1 DATE OF TEST:

C-2 MATERIAL OF CONSTRUCTION

Sl No.	Component	Material and Size
(1)	(2)	(3)
i)	Frame	
ii)	Deck	
iii)	Blower impeller	
iv)	Good grain outlet	
v)	Reject outlet	
vi)	Feed hopper	
vii)	Main shaft	
viii)	Transmission system	
ix)	Pullies, gears, sprockets, etc	
x)	Cam, eccentric, crank, etc	
xi)	Spring	
xii)	Others	

Test Engineer

ANNEX D

[*Clause* 10.4.1.1, *and* 10.4.1.2 (c)]

DATA SHEET FOR VISUAL OBSERVATIONS AND PROVISION FOR ADJUSTMENTS

D-1 OBSERVATIONS

a) Adequacy of marking inlet and outlets
b) Adequacy of marking of direction of rotation of drives
c) Adequacy of protection of bearings against ingress of dust
d) Adequacy of safety arrangements, specially near moving parts
e) Provision for lubrication of moving parts
f) Provision for belt tightening
g) Provision for transportation
h) Provision for fixing on level hard surface
j) Provision for easy changing of components requiring frequent replacement
k) Provision for anti-corrosive coatings
m) Tightness of bolts and nuts and other fasteners
n) Other observations

D-2 PROVISION FOR ADJUSTMENT OF:

a) Feed rate
b) Deck oscillation speed
c) Blower impeller speed
d) Deck slopes
e) Air flow rate

Test Engineer

ANNEX E

(*Clause* 10.4.1.2)

DATA SHEET FOR TEST AT NO LOAD

E-1 SOURCE OF POWER

E-2 TYPE OF DRIVE

E-3 TOTAL TIME OF RUN, min

E-4 AVERAGE POWER CONSUMPTION FOR ONE HOUR, W

E-5 OBSERVATIONS:

a) Presence of any marked vibration during operation
b) Presence of undue knocking or rattling sound
c) Frequent slippage of drive belt
d) Any marked unusual wear or slackness in any component
e) Any marked rise in bearing temperature
f) Any marked scene of failure or breakage or damage to any parts or components of destoner
g) Any marked change in oscillation or slope
h) Other observations

Test Engineer

ANNEX F

(*Clause* 10.4.1.3)

DATA SHEET FOR TEST AT LOAD

F-1 SOURCE OF POWER

F-2 POWER RATING, kW

F-3 MACHINE DETAIL

a) Stroke length of deck
b) Oscillation of deck (number of strokes/min)
c) End slope of deck, degree

F-4 SEED/GRAIN

a) Type of seed/grain
b) Variety of seed/grain
c) Average size of seed/grain
d) Moisture content, percent dry basis
e) Fraction of impurities/stones present before feeding

F-5 TEST DATA

Sl No.	**Date**	**Starting Time**	**Stopping Time**	**Duration of Operation**	**Speed m/min**	**Feed Rate**	**Power Required**	**Fuel Consumption**	**Total Quantity of Good Grain at Main Grain Outlet**	**Sample Collected from**	**Quantity (kg) of Samples from Sample No.**		
											(i)	(ii)	(iii)
					(rev/min)	(kg/h)	(kW)	(l/h)	(kg)				
										Feed			
										Good grain outlet			

Table (*Concluded*)

Sl No.	**Date**	**Starting Time**	**Stopping Time**	**Duration of Operation**	**Speed m/min**	**Feed Rate**	**Power Required**	**Fuel Consumption**	**Total Quantity of Good Grain at Main Grain Outlet**	**Sample Collected from**	**Quantity (kg) of Samples from Sample No.**		
											(i)	(ii)	(iii)
					(rev/min)	(kg/h)	(kW)	(l/h)	(kg)				
										Stone outlet			

The data should be collected for every test conducted on different feed rates if necessary.

F-6 OBSERVATIONS

a) Presence of any marked vibration during operation
b) Presence of undue knocking or rattling sound
c) Frequent slippage of belts
d) Smooth running of shafts in their respective bearings
e) Frequent clogging
f) Frequent loosening of fasteners
g) Frequent clogging of grain in elevator unit
h) Smooth flowing of material through different components
j) Any marked rise in bearing temperature
k) Any marked wear, deformation and breakdown
m) Frequent loosening of fasteners
n) Other observations, if any

Test Engineer

ANNEX G

[*Clause* 10.4.1.3, *Sl No.*(3)]

DATA SHEET FOR ANALYSIS OF SAMPLES

Sl No.	**Feed Rate** (kg/h)	**Sample Source**	**Sample Mass** (g)	**Mass of (g)**								**E/F/G**
				Good Seeds/Grain				**Stones**				
				Sample No.				Sample No.				
				i	ii	iii	Mean	i	ii	iii	Mean	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		Feed	100									*F* = (8)/(4)
		Good grain outlet	100									*E* = (8)/(4)
		Stone outlet	100									*G* = (8)/(4)

E = mean of fraction of good seeds/grains at good grain/seed outlet;
F = fraction of good seeds/grains in feed; and
G = mean of fraction of good seeds/grains at rejection/stones outlet.

Test Engineer

ANNEX H

[*Clause* 10.4.1.3, *Sl No.*(d)]

DATA SHEET FOR EFFICIENCY, POWER REQUIREMENT AND CAPACITIES

Sl No.	**Item**	**Test No.**					
		1	2	3	4	5	etc
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Feed rate, in kg/h						
ii)	Power required, in kW						
iii)	Vibration of deck (m/min)						
iv)	Total grain received at clean grain outlet, in kg						
v)	Effectiveness of separation of stone, decimal						
vi)	Rated input capacity, in kg/h						

Test Engineer

ANNEX J

(*Clause* 10.4.1.5)

DATA SHEET FOR LONG-RUN TEST

J-1 TOTAL RUNNING TIME, h

J-2 CONTINUOUS RUNNING TIME, h

J-3 BREAKDOWNS IN SEPARATION UNIT (DECK)

J-4 BREAKDOWNS IN OUTLETS/CHUTES/ELEVATION UNIT

J-5 BREAKDOWNS IN THE MAIN FRAME

J-6 ANY MAJOR REPAIRS CONDUCTED

J-7 ANY OTHER OBSERVATIONS AFFECTING THE PERFORMANCE

Test Engineer

ANNEX K

(*Clause* 10.5)

SUMMARY REPORT

K-1 NAME AND ADDRESS OF MANUFACTURER

K-2 MODEL NUMBER

K-3 NAME OF TESTING STATION

K-4 BRIEF DESCRIPTION OF THE MILLET DESTONER

K-5 TYPE AND VARIETY OF MILLET USED

K-6 PERCENTAGE OF FOREIGN MATTER PRESENT BEFORE FEEDING

K-7 MOISTURE CONTENT OF RAW MATERIAL, percent d.b.

K-8 PROVISIONS FOR ADJUSTMENT:

a) Speed of vibration/oscillation of deck
b) Screen slope
c) Air displacement
d) Feed rate

K-9 POWER REQUIREMENT, kW

a) Observed power at no-load
b) Observed power at load at rated input capacity
c) Observed power at maximum input capacity
d) Recommended power

K-10 EFFECTIVENESS OF SEPARATION OF STONE

K-11 RATED INPUT CAPACITY, kg/h

K-12 ANY MARKED OBSERVATION AFFECTING PERFORMANCE

K-13 ANY MARKED BREAKDOWNS

K-14 OTHER OBSERVATIONS

Test Engineer

ANNEX L

(*Foreword*)

COMMITTEE COMPOSITION

Agriculture and Food Processing Equipment Sectional Committee, FAD 20

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